Vintage Radio

By RODNEY CHAMPNESS, VK3UG

The versatile multi-band Ferris 174 portable

Radio sets were expensive 50 years ago, so sets that could take on the combined role of a car radio, a domestic receiver and a personal portable found a ready market. One such set was the multi-band Ferris 174 8-transistor radio.

MOST OF THE larger Australian radio and TV manufacturers, including AWA, HMV and Astor, concentrated on producing items that were sold in their thousands. Before the advent of TV, these products were mainly four and 5-valve radios, either 240V mains-operated or broadcast-band valve portables. In addition, several manufacturers produced some outstanding car radios.

Commercial production of mains-operated TV receivers began in 1956 and again the manufacturers concentrated on items that would sell in large quantities. Previously, they had produced radios to suit AC/DC mains, some fine 32V receivers and a few high-quality multi-band receivers but when it came to TV sets, no 12V or 32V-powered receivers were made locally.

In those days, there was a strong demand for electronic equipment – radios mostly – that could be used by people in rural areas where there was no mains power. Radios in the 1950s, 60s and 70s were still relatively expensive and a set that could be used in many different situations would be an attractive product.

In particular, a radio that could be used as a household receiver, a car radio and a portable receiver would find a ready market. It would cost more than a conventional set but it would still work out cheaper than having to buy three separate sets.

Ferris radios

Fortunately, one Australian manufacturer, Ferris Brothers Pty Ltd, stepped into this niche market. Ferris was not a mainstream manufacturer and did not concentrate on the common four or 5-valve mantel receivers of the era. Instead, it was a specialised manufacturer that produced many innovative radio and allied electronic products.

Ferris Brothers commenced business around 1934 and subsequently specialised in car radios. However, the Australian Official Radio Service Manuals (AORSM) do not list any Ferris sets until 1946, so Ferris was probably quite a small manufacturer up until that time.

Their products became more readily available after World War II and by 1947 they were producing a car radio that could not only be powered from a 12V battery but from 240V AC as well. It featured an elementary noise limiter, as did a bus radio that came out in the same year.

By 1949, the company was producing a 3-band car radio cum domestic receiver complete with noise limiter. The engine bay layouts of vehicles from that period were not conducive to minimising spark ignition noise, so noise limiters were a necessary feature of such sets.

In 1955, Ferris started building AC/battery-powered portables which had provision to plug in a car radio antenna. They subsequently found that, with the advent of transistors, they could make radios that were truly portable. These sets could also be used as car radios when plugged into a cradle or they could be laid on the seat in a safety bracket – rather like a seat belt for radios (and well before they became compulsory for humans)!

As with their earlier sets, these new sets were designed to connect to a car's radio antenna.

Many such sets were also considered suitable for use as domestic receivers, as they had quite a large battery fitted. Some also featured shortwave reception so that those people in remote areas could at least listen to the ABC's shortwave inland service. These sets were also of considerable interest to people interested in listening to shortwave radio as a hobby.

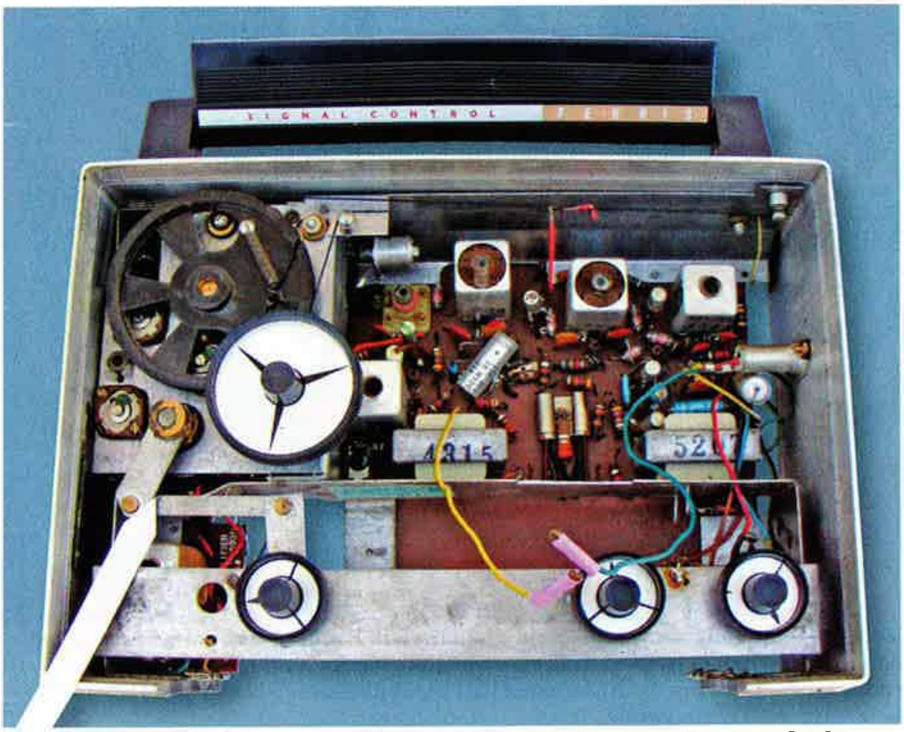
This ABC's inland service, by the way, was disbanded several years ago and replaced by the "HF Shower" service. It emanates from Alice Springs, Tennant Creek and Catherine and broadcasts on the 2MHz and 4MHz bands.

The Ferris 174 receiver

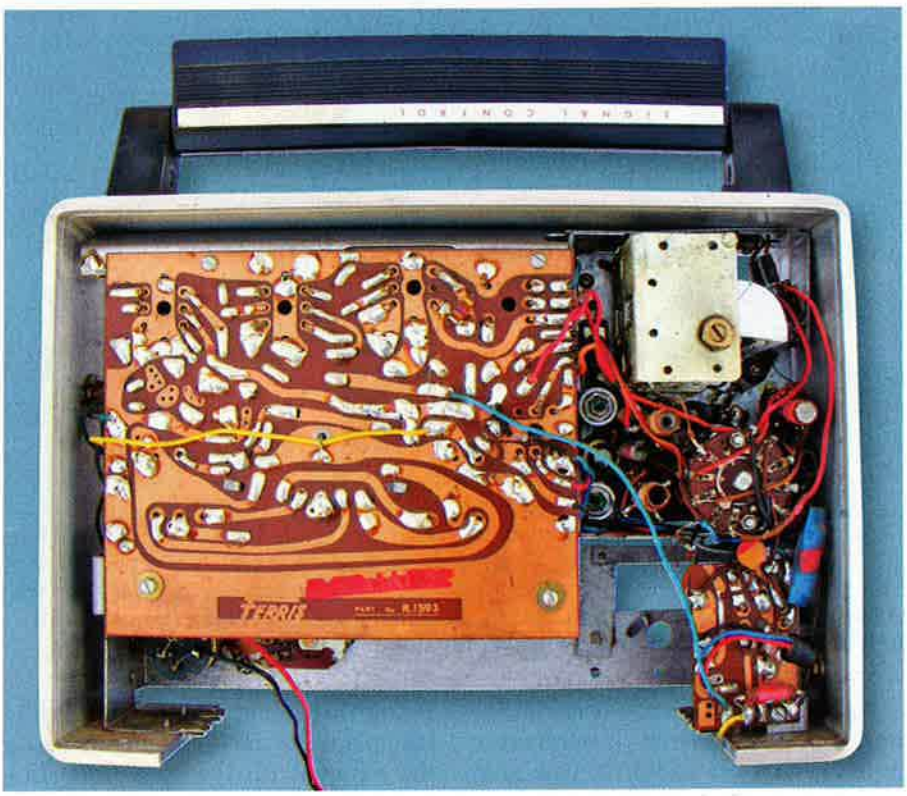
The Ferris multi-purpose model 174 came out in 1963. This set was enclosed in an attractive gunmetal grey aluminium case and measured 255 x 220 x 100mm (W x H x D), including the knobs. The back features a black perforated aluminium sheet while the front also features a perforated aluminium sheet, which is coloured black and off-white.

In keeping with the theme, the knobs are black and white, while the slide-rule dial scale is finished in black, white and blue, with a red dial pointer.

The ferrite rod antenna is encased in a plastic rectangular sleeve, which swivels along its longest axis. It is located on the top of the set and also acts as the carry handle. The cabinet certainly isn't as flashy as some transistor radios of the era but has a real no-nonsense look about it.

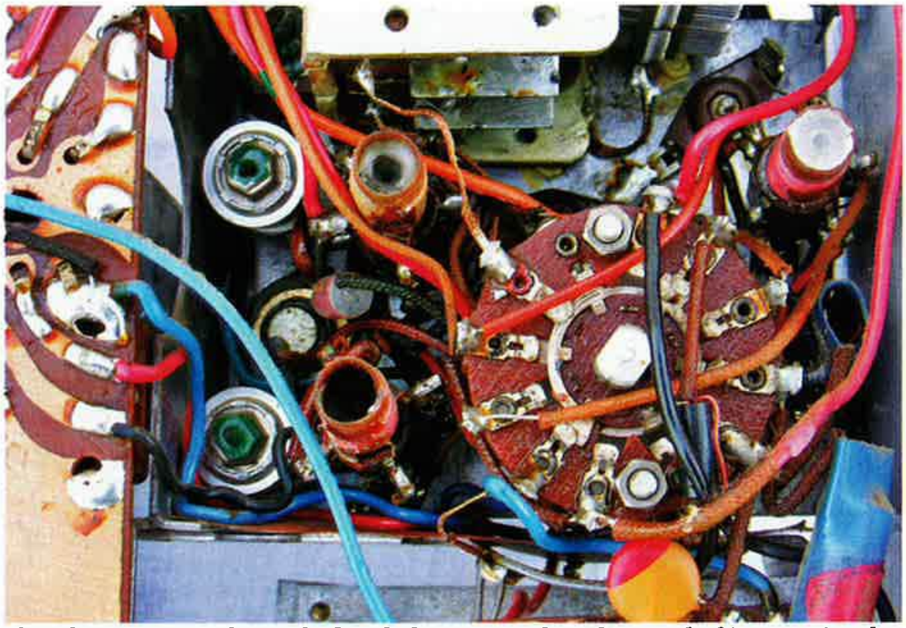


This is the view inside the front of the set with the front panel removed. The cardboard pointer at left indicates the mechanical linkage between the band-change switch and its front-panel control knob.

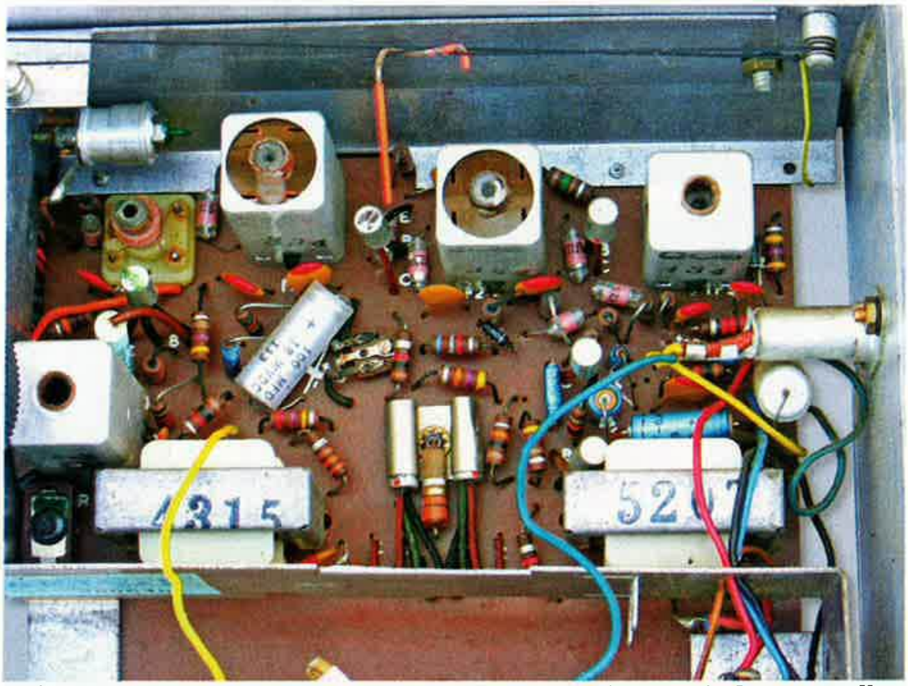


The rear view inside the set is dominated by the PC board, with the tuning gang and band-change switch to the right. The ferrite rod antenna is hidden inside the handle.

The model 174 was produced over a 4-year period until at least 1967 and sold for $124.50 – about 50% more than a good car radio of the era and much more than the average wage at the time. It was supplied complete with a car seat bracket and a wire indoor antenna.



This close-up view shows the band-change switch and several of its associated coils. The switch is used to select between the ferrite loop antenna and a car radio antenna on the medium-wave band and also to select the 2-6MHz and 6-18MHz shortwave bands.



A close-up view of the main PC board. Despite its age (40 years), the set is still in quite good condition and required only minor work to get it going.

Basically, the Ferris 174 was a multi-purpose, 8-transistor, triple-wave, portable-cum-car radio. It was also touted as being quite suitable as a cordless mantel receiver.

Metal case

As was common to most Ferris receivers, the model 174 used a metal case and this ensured good shielding of the circuitry from interference. This meant that signal pick-up could only take place via the car's antenna or via the external (to the case) loopstick antenna. Some extraneous interference may have been able to penetrate the receiver if an external speaker was in use, although this is likely to have been minimal.

In the vehicles of the era, a conventional portable radio sitting on the seat of the car suffered severe interference if the engine was running. There were two reasons for this: (1) interference from the ignition system and other electrical equipment, even if "suppressed", was still high enough to severely mar reception; and (2) the metalwork of the vehicle acted as a Faraday shield and this reduced the signal picked up by the ferrite rod antenna. This shielding effect also acted to concentrate the interference within the cabin of the vehicle.

As a result, most Ferris portables, including the 174, featured a shielded case (just like purpose-built car radios) and included a socket to plug in an external car radio antenna. Ferris did their homework well – their sets worked well in a car but most portables from other manufacturers were unsuitable in this role because the problems outlined above were not addressed.

As well as the car radio antenna, the band switching in the receiver also allows either a long-wire antenna or the loopstick antenna system to be used on the broadcast band (530-1620kHz). On shortwave, the receiver can be switched to cover 2-6MHz or 6-18MHz but must be used with an external antenna, whether in a car, in the home or out in the "bush".

On the shortwave bands, the receiver was often used by people who needed to listen to relatively weak stations such as the Royal Flying Doctor Service, bushfire brigade communications and small ships (fishing boats). It was also used by those who wanted to listen to shortwave services such as the abovementioned ABC inland service, the BBC and VOA, etc.

The set used a No.286 battery which gave up to 1000 hours of operation before replacement was needed. In fact, the set will work with a supply voltage as low as 5V, which meant that every last bit of electrical energy could be wrung out of the battery. This also meant that it was quite economic to use it as a battery-powered domestic receiver (ie, without recourse to the use of a mains power adaptor).

So the Ferris 174 was a very versatile set. At home, it could be powered from a mains adaptor (or from batteries). On the way to the beach, it could easily be connected to the car's radio antenna via the coaxial antenna cable. And at the beach, it could be used as a true portable.

Even so, you probably would not want to have to carry the set too far.

With its battery installed, it weighs in at about 4kg so it is not exactly a lightweight.

Circuit details

Fig.1 shows the circuit details. It uses eight transistors and delivers good sensitivity over the three bands tuned. The transistors are second-generation germanium types, which were more sensitive and had lower noise than the original OC44 and OC45 series.

The input circuit is relatively complex, with a 4-pole 4-position switch section used to select between the ferrite loop antenna and the car antenna (or a long antenna). An OC171 PNP transistor is used as the radio frequency (RF) amplifier and the amplified signal is then fed on to a second OC171, which acts as an autodyne converter.

The various coils (10 in all) are switched using another 10 poles on the 4-position wave-change switch. A total of 20 adjustments is required to accurately align the front-end of the receiver, while the intermediate frequency (IF) amplifier requires a further five adjustments.

Following the converter is a 2-stage IF amplifier based on two OC169 transistors. Neither of these transistor stages is neutralised. Note also that the emitter of the second IF transistor stage is not bypassed, which improves its ability to deal with strong signals.

Following the IF amplifier is an OA91 detector diode. This is biased close to its conduction point by resistors R17, R18 & R19 and this greatly improves the sensitivity of the detector.

A second OA91 diode is used to derive the automatic gain control (AGC) voltage. This voltage is fed to the base of the RF amplifier transistor via R16 & R2. The AGC voltage rises as the signal strength increases, to gradually cut this transistor off. In addition, its emitter is connected to the base circuit of the first IF amplifier (OC169) and so the forward bias on the latter is also reduced, which reduces its gain with strong signals.

Note that the forward bias for the RF stage (OC171) is adjusted by trimpot R3. However, the service manual makes no mention of the circumstances under which R3 is adjusted. In practice, I suspect that it was adjusted during manufacture to give best performance when the receiver was tuned to a weak signal.

Following the detector is a three-stage audio amplifier based on two OC71s and two OC74 transistors. The OC74 class-B output pair are driven in push-pull fashion by transformer T1 and in turn drive the internal loudspeaker via transformer T2.

There is also provision for an external speaker to be plugged in (doing this automatically disconnected the internal unit). This allowed a larger car speaker to be used, to give improved audio performance in a noisy cabin.

Negative feedback in the audio amplifier is derived from one side the speaker-transformer secondary winding. This feedback signal is applied via R36 to the base of the OC71 audio driver-transistor (ie, the transistor driving transformer T1).

Preventing thermal runaway

Germanium transistors are very sensitive to heat and draw more current as they heat up. This increased current then leads to even more heating and can soon escalate into thermal runaway which can destroy the device.

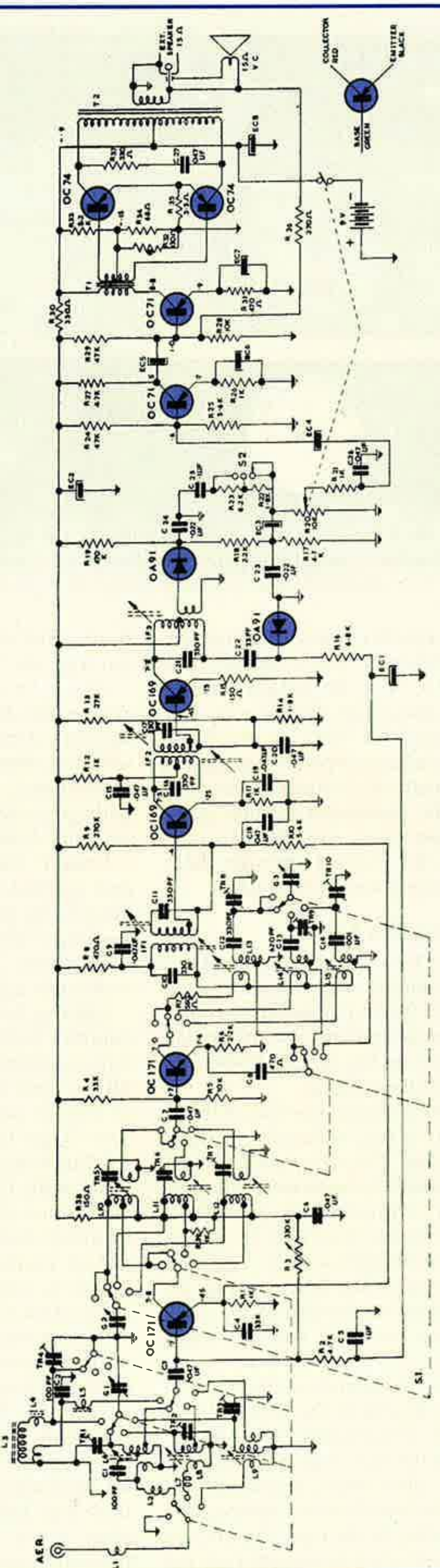
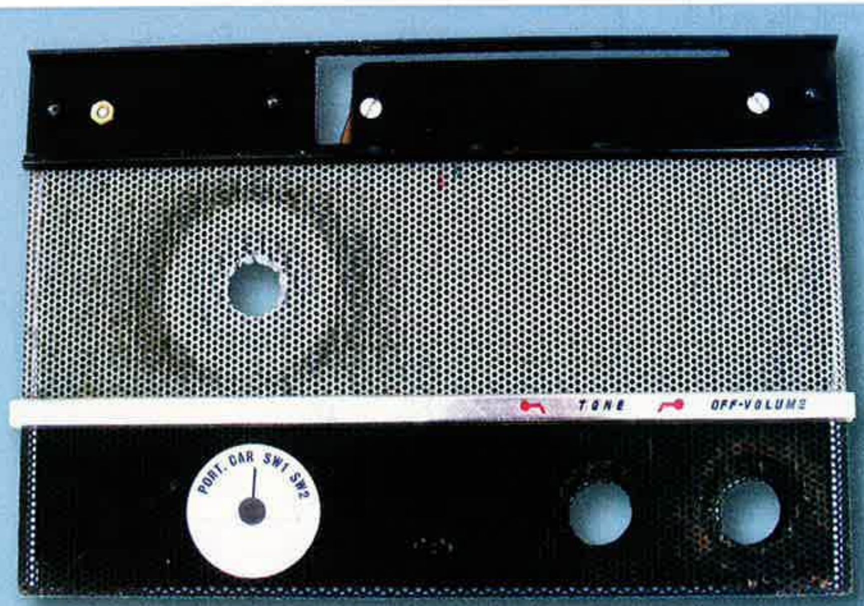


Fig.1: the Ferris 174 is a fairly conventional superhet receiver based on eight germanium PNP transistors. An OC171 functions as an RF amplifier, while a second OC171 acts as an autodyne converter. This is followed by a 2-stage RF amplifier based on two OC169 transistors, while the remaining OC71 & OC74 transistors form a 3-stage audio amplifier. An OA91 diode is used as the detector, while a second OA91 is used to derive the AGC voltage.



This is the front panel prior to restoration. It was cleaned and resprayed with off-white and flat black paint, so that it now looks new again.

To prevent this, special precautions must be taken to thermally stabilise the two OC74 audio output transistors. In this circuit, this is achieved using thermistor R32. Its resistance decreases as the temperature rises and this automatically reduces the forward bias on the transistors as their junction temperatures rise. This in turn stabilises the current through them and prevents thermal runaway.

Restoring the 174

The unit featured here was obtained from a member of my local vintage radio club. It was handed to me completely unrestored and its owner also kindly lent me the service manual to help with this column.

The receiver looked as though it had had plenty of use, with some scuffing of the cabinet. The cabinet also looked a bit shabby in the areas where the perforated aluminium panels are fitted.

Removing the front and back panels is quite straightforward. The back panel is removed by first undoing two screws along the bottom of the case, after which the back can be swung out.

The front panel first requires the dial pointer to be run to the lefthand end of the dial. Three screws are then undone from the dial scale which is then removed. That done, the knobs are removed followed by two more screws on the bottom of the case. Finally, the speaker leads are disconnected and the front panel removed by swivelling it out from the bottom.

As can be seen in one of the photographs, the front panel in particular had lots of marks. I cleaned the mesh with fine wet-and-dry paper and then used a damp, soapy rag to remove any body grease from the front panel. This was then followed with a damp rag.

Once it was cleaned, I masked off and applied some off-white and flat black spray paint to the various panel sections. This considerably improved the appearance of the panel which now looks new again.

Getting back to the receiver, all controls worked as they should and only required a little sewing-machine oil on their various moving surfaces to ensure continued smooth operation. To get into awkward spots, I use a 2.5ml hypodermic syringe partially filled with the required lubricant (I also blunt the needle on a grinder to avoid accidents). That done, the switch contacts were sprayed with Inoxa, as corrosion was evident on some of them.

A close examination of the internals of the set revealed nothing out of the ordinary apart from the RF transistor, which was wrapped in black insulation tape. Unwrapping the transistor revealed that it was not an OC171 but an equivalent in a different package that had been substituted at some stage in the set's life. I got rid of the insulation tape and slipped some neat-fitting black tubing over the transistor to make it look a bit tidier.

Testing the receiver

With everything appearing to be in order, I connected a 9V supply to the set and switched it on. The receiver immediately began operating which was a pleasant surprise. I left it operating for an hour or so and it happily continued playing with no fuss.

It was now time to check and adjust the alignment if necessary. First, I checked the IF alignment and found it to be very slightly out. Unfortunately, I had trouble adjusting one core as a previous owner (not the current owner) had used beeswax to "lock" it in place.

Aligning the three tuned bands also proved to be less than straightforward. The problem here is that the dial scale and the front and back covers of the set must be removed to gain access to the tuning adjustments.

That meant that I couldn't align the set by tuning to various stations and adjusting it so that the dial markings correctly coincided with the pointer. Instead, I had to rely on the tune-up information which specifies the frequencies tuned with the gangs closed and fully open.

Fortunately, this proved to be fairly satisfactory and the calibrations were near enough for all practical purposes. However, I'm quite sure that with a bit more work, Ferris could have designed the cabinet so that the dial-scale could have remained in-situ while the alignment adjustments were carried out.

The next step was to align the broadcast band on the car radio setting of the band-change switch. This went smoothly but because I wasn't using a car radio antenna, trimmer TR1 will probably require further adjustment when the set is actually tested in a car. The oscillator adjustments were accurate enough on all bands, so these were left untouched.

The 2-6MHz band also tuned up easily, as did the 6-18MHz band. However, I had to be careful not to peak the image signal rather than the correct signal on the 6-18MHz band, as image rejection is poor at the top end of this band. In fact, this is a common problem with most sets using a 455kHz IF amplifier.

As before, a few of the coil cores were partially sealed with wax but by picking some of it out, I was eventually able to adjust all the coils. The alignment techniques used were covered in my articles for December 2002 and January-February 2003.

The final step in the alignment involves adjusting the loopstick tuned circuit. To gain access to the loopstick antenna, it is necessary to first lift the ends of the Ferris name strip on the handle and then remove the two screws at its ends. That done, you then pull the two sections apart to reveal the loopstick.

Care must be taken here, as it's all too easy for the loopstick to fall out of the handle and break. To adjust it, it is necessary to keep it in the same position as it would normally occupy and slide one of the two coils along the rod for best performance at the low-frequency end of the broadcast band.

It tuned up quite well but when I moved to the high-frequency end of the band, I was unable to peak the circuit correctly. Initially, I tried placing additional fixed capacitors across the trimmer capacitor but to no avail. The circuit was definitely not peaking because when I brought my hand near the loopstick (which added capacitance across the coil) the performance improved.

Wiring error

There was nothing obviously wrong, as the soldered connections and switch contacts were in good order. I then looked to see if anything was wrong with the wiring and it didn't take long to discover that TR4 was wired to the top contact of the switch going to C3 rather than to the bottom of L4. I rewired TR4 to the correct position in the circuit and the tuning adjustments then peaked, just as they should.

Next, I tried adjusting trimpot R3 to see what effect it had and found that it adjusted the receiver's sensitivity. If I adjusted it too far one way, the set would oscillate, but the set works quite well with it adjusted just below the point of oscillation.

Further tests showed that the dial drive is quite positive in its action with no discernible backlash, even when tuned to around 17MHz.

I ran the set off a small regulated power supply for all my tests. In practice, the set is designed to run off a 286 battery but these are no longer available. However, WES Components have a 276P battery which should be suitable. Battery packs made up of six 'AA' cells or of six 'C' cells will also easily fit in the battery compartment and it may even be possible to install packs with six 'D' cells.

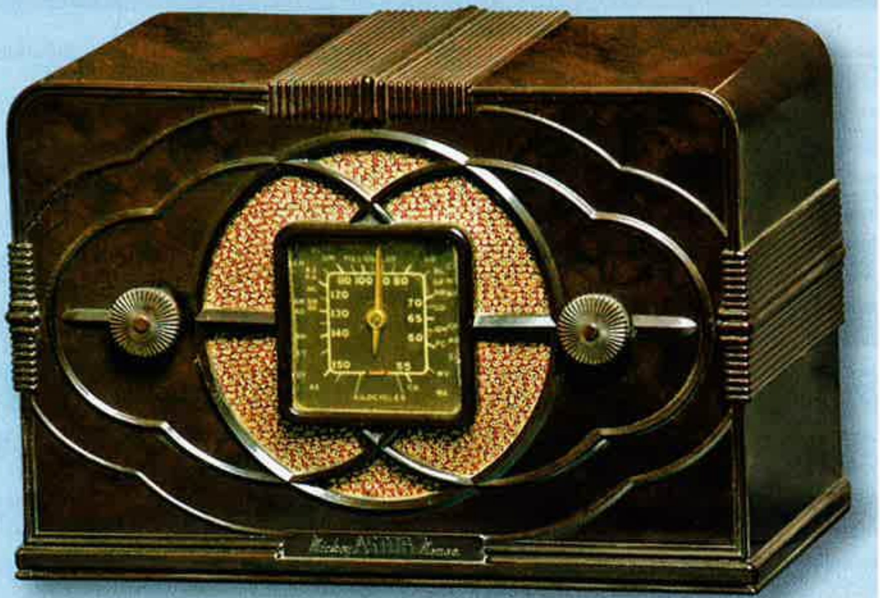
Note, however, that it will be necessary to protect some parts in the set when fitting these replacement batteries. This can be done using pieces of corrugated cardboard around the battery compartment to prevent battery movement.

Summary

The Ferris 174 is one set that lived up to its advertising claims. In fact, I liked it so much that I eventually obtained one for myself.

In summary, this is an excellent receiver that has everything a listener might want except an FM band. **SC**

Photo Gallery: Astor "Mickey Mouse"



The Astor Mickey came in a very compact cabinet and was one of the earliest Australian bakelite radios, being a modified version of an American receiver. In fact, Astor used American circuits for some years, often changing parts to less than optimum values to save a few pennies.

Early Australian Mickey radios had the name "Mickey Mouse" and a drawing of Mickey on the rear – without an agreement! Astor forgot to tell Disney and Walt Disney was not amused. Legal action resulted in the name being altered to just plain "Mickey", no doubt with Astor pleased to still get some mileage from all their previous advertising.

The receiver was a great performer, considering the component limitations at the time. The valve line-up varied through the model's life but typically included a 5Z4 rectifier, a 25A6 audio output stage and 6Q7, 6K7 and 6A8 valves for the RF and IF stages. Photo supplied by the Historical Radio Society of Australia Inc (HRSA), PO Box 2283, Mt Waverley, Vic 3149. www.hrsa.net.au